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NURSING RESOURCE CONSUMPTION:
DRG 209, A DESCRIPTIVE STUDY

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ABSTRACT

NURSING RESOURCE CONSUMPTION:
DRG 209; A DESCRIPTIVE STUDY

by Michael Thille

The purpose of this study was to identify and evaluate the impact of clinical variables and organizational costs on nursing resource consumption during the treatment of Medicare patients (N=76) within DRG 209 (major limb and joint reattachment). This retrospective, descriptive study, conducted at a 468-bed district hospital, analyzed direct and indirect nursing cost components. Mean total nursing cost per case was $3131, or 31.2% of Medicare reimbursement. Direct nursing care costs accounted for 56.1% of the mean total nursing cost, and indirect nursing care costs accounted for 43.9%. The direct care cost portion of total cost, mean direct care hours, mean length of stay (LOS), and mean total nursing cost increased with the age of patient and with the number of complicating conditions (CCs) per case. Variance in cost, direct care hours, and LOS decreased considerably among cases when grouped by age and CC.

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INTRODUCTION

Statement of the Problem

Health care continues to claim an ever increasing portion of the gross national product (GNP) in the United States. In 1965, $41.9 billion or 5.9% of the United States GNP was spent on health care; in 1975, $132.7 billion or 8.3% of the GNP, and in 1985, $425 billion or 10.7% of the GNP was spent on health care (Walde, Levit, & Lazenby, 1986). In an attempt to control medical expenditures, Congress passed Public Law 98-21 as a component of the Social Security Amendments of 1983 instituting the diagnosis-related group (DRG) classification and reimbursement system for payment of inpatient hospital care for Medicare beneficiaries.

Under the current Medicare system, diagnostic-related groups are derived from taking all possible diagnoses identified in the International Classification of Diseases, Ninth Revision, Clinical Modifications (ICD-9-CM), classifying them into twenty-three major diagnostic categories (MDC) based on physiology systems, and further breaking them into 468 distinct "medically meaningful" groupings. It is postulated that patients within the same DRG can be expected to demonstrate a set of clinical responses which will result in an approximately equal use of

hospital resources on a statistical average. Hospitals are paid a predetermined fixed amount for provision of treatment to Medicare patients within a specific DRG category. Consequently under the DRG model, the generation of hospital revenue has shifted from a cost-based retrospective system to a diagnosis-based prospective payment system.

Over the past six years the prospective payment environment has motivated hospital management to re-evaluate and redefine patient care. The organizational focus on treatment goals and mechanisms to achieve these goals was born in a cost-based environment where medical care expenses were passed along to the private payer, insurance carrier, and state agency. The recent imposition of fixed prospective payment schedules forces health care organizations to change their cost-based production model to remain fiscally viable. Foremost is a shift in managerial orientation from a goal-driven organizational model to a revenue-driven model in which available revenue strongly influences all other decisions. Treatment goals must now co-exist with budgetary constraints inherent in an environment of limited revenue.

Quantifying the hospital costs and nursing costs of 468 distinctive DRGs requires a vast investigative process that is still in its infancy. Further, there is strong consensus among the health care community that significant cost variation exists among patients within the same DRG. Hospital

resource consumption studies have recently focused on clinical variables such as age, complicating conditions (CCs), and mode of admission (emergency department admission or non-emergency department admission), and have found that these clinical characteristics do impact on the cost per case within the same DRG.

Nursing resource consumption studies, too, have begun to collect data specifically on the impact of clinical variables, and although such studies are still few in number, the accumulation of nursing cost data has made it possible for nurse administrators to begin identifying where their revenue dollars are going and evaluating the efficiency of these revenue dollars in meeting treatment goals. Presently, nursing resource consumption studies have accumulated nursing cost data for only a handful of DRGs, but in each of the studies, large variations in the nursing cost per case was present. Not included in this body of nursing knowledge is DRG 209 (major limb and joint reattachment) cost data associated with hip fractures, a frequent and costly health care problem in the elderly Medicare population. Identifying nursing costs associated with the care of this patient population, and evaluating the impact of clinical variables on nursing costs, is important to the financial management of nursing services, particularly surgical/orthopedic nursing units. This study, then, proposed to identify and evaluate

nursing resource consumption variables inherent in the medical treatment of Medicare patients with a principal discharge diagnosis of major limb and joint reattachment (DRG 209).

Research Questions

This study asked the following research questions:

1. What is the impact of organizational costs (direct nursing care costs vs. indirect nursing care costs) on nursing resource consumption within DRG 209?

2. What is the impact of clinical variables (age, complicating conditions, and mode of admission) on nursing resource consumption within DRG 209?

Purpose of the Study

The purpose of the study was to identify and evaluate clinical variables and organizational costs that impact on nursing resource consumption during the treatment of Medicare patients within DRG 209 at a 468-bed general acute care district hospital in the San Francisco Bay Area.

Significance of the Study

The cost and quality of nursing care has a significant impact on the cost of hospitalization. Nurse administrators need to know where their nursing unit dollars are being spent and what variables impact on the consumption of this resource. Only with this information can nurse administrators participate with hospital administrators in

planning and implementing successful fiscal and patient care strategies.

This study contributes to the body of nursing knowledge by providing DRG 209 nursing resource consumption information using a detailed and systematic cost-accounting methodology. Moreover, this study identifies clinical variables and organizational costs which significantly affect on the nursing resource consumption of DRG 209, a non-age, non-CC stratified DRG classification.

This particular DRG was selected because of its prevalence among elderly surgical orthopedic inpatients nationwide. In fiscal years 1984 and 1986 respectively, DRG 209 was the 14th and 8th most frequently occurring diagnosis-related group as ranked by the Health Care Financing Administration (HCFA), Bureau of Data Management and Strategy. In fiscal year 1987, DRG 209 was the 5th most frequently occurring DRG as ranked by HCFA. Moreover, HCFA 1987 fiscal year data identifies DRG 209 as the 2nd most costly DRG based on Medicare disbursements for hospitalized beneficiaries (Callahan & Lawrence, 1988). During the study period, DRG 209 was the 4th most frequently occurring DRG among the inpatient population at the study setting, accounting for the greatest total number of inpatient days and the highest total Medicare reimbursement among DRGs.

Definition of Terms

For the purpose of this study, the following definitions apply:

1. Comorbidity: a medical condition present on admission to the hospital identified as a complicating condition (CC) (International Classification of Diseases, Ninth Revision, Clinical Modifications, 1986)

2. Complication: a medical condition acquired during the course of the inpatient stay identified as a complicating condition (CC) (International Classification of Diseases, Ninth Revision, Clinical Modifications, 1986)

3. Direct nursing care costs: all unit-based expense associated with the nursing time required by a patient as measured by the patient classification system.

4. Indirect nursing care costs: all non-unit based expense (allocated overhead) associated with support services that create the structure on which direct nursing care depends as measured by the patient's length of stay.

Research Design

This retrospective, descriptive study collected cost data and clinical data on Medicare patients within DRG 209 who were admitted to and discharged from a 468-bed general acute care district hospital between July 1, 1988 and March 31, 1989. The study population was divided into subgroups

based on age (65-69, 70-74, 75-79, 80+), number of complicating conditions (no CCs, one-two CCs, or three-four CCs), and mode of admission (emergency department admission or non-emergency department admission). Age, ICD-9-CM diagnosis code, and mode of admission information was retrieved from a in-hospital case-mix database. Patient acuity data for the calculation of direct nursing care hours and length of stay was retrieved from portable computer disks. Central tendency statistics were employed for cost analysis within each subgroup. Cost analysis included direct nursing care costs and indirect nursing care costs.

Limitations

The validity and reliability of the hospital's patient classification system (PCS) is limited in scope to this specific facility and its patient population, although it is similar to other factor-type classification tools in form and methodology. The PCS, implemented to quantify individual patient acuity by acuity points and convert the acuity points to direct nursing care hours, is a unique "in-house" classification tool. Consequently, the generalization of these nursing cost findings to patient populations outside this health care facility is limited.

Chapter 2

CONCEPTUAL FRAMEWORK AND REVIEW OF RELATED LITERATURE

Conceptual Framework

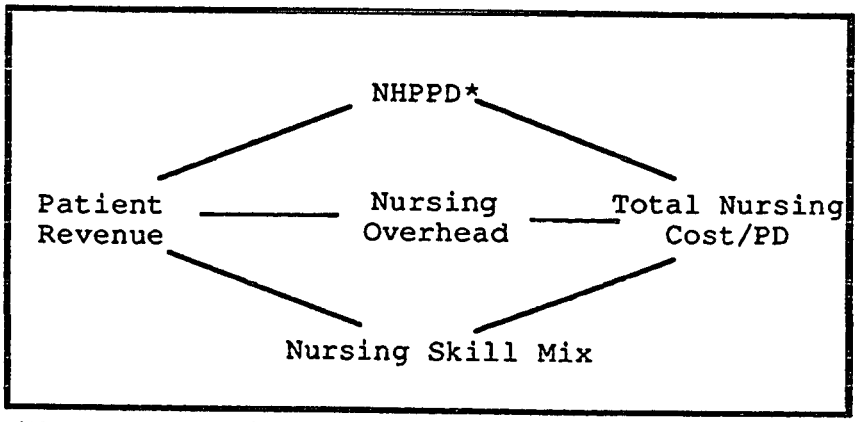
The broad definition of a product is anything that can be offered to the market for attention, acquisition, or consumption, such as physical objects, services, persons, places, organizations, and ideas (Kolter, 1980). It is whatever will fulfill a specific need, want, or desire. Where a service is involved, "a product covers essentially everything related to seeking, undergoing, and being affected by the service experience" (MacStravic, 1986, p. 36). Within the health care setting, product-lines are sets of activities and experiences that are offered and consumed by an identifiable set of persons in ways that are different from other sets (MacStravic, 1986). Because diagnostic-related groups operationally define the products of hospitals in terms of classes of patients with similar sets of services, they lend themselves to the development of product-lines (Fetter & Freeman, 1986).

In the prospective payment environment, revenue generated from hospital product-lines (DRGs) strongly influences all management decisions if the organization is to survive. Similarly, in the fiscal management of nursing services (a major labor expenditure within hospital product-

lines), nurse administrators need to identify and evaluate the costs of their services within hospital product-lines. In a "resource-driven costing/productivity model" (Figure 1), the revenue received by the hospital for patient care drives the nurse administrator's choices regarding nursing hours per patient day (NHPPD), staff mix, and the nursing department's organizational structure (Strasen, 1987). Nursing cost per day is a function of the direct nursing hours provided to patient, the particular skill mix of the staff selected, and the nursing overhead (i.e., allocated non-unit based nursing service operating expense and allocated hospital overhead). This model acknowledges that trade-off decisions are inevitable in a fixed rate prospective payment environment

Figure 1

Resource-Driven Costing/Productivity Model



*NHPPD = Nursing hours per patient day

Note. From "Standard costing/productivity model for nursing" by L. Strasen, 1987, Nursing Economics, 5(4), p.160.

The resource-driven costing/productivity model is made operative by a series of costing systems:

a) A patient classification system that accurately and reliably categorizes patient populations by acuity scores;

b) A staffing system wherein the size and mix of nursing staff are determined and assigned to care areas according to patient acuity demand;

c) A costing system that allows for the identification and categorization of costs of nursing services at each acuity level; and,

d) An audit system that monitors and verifies both patient acuity levels and staffing allocations. (Van Slyck, 1985).

Review of the Literature

Nursing Resource Consumption and DRG's

Significant variability in nursing costs within DRG's has been consistently replicated in cost studies since the implementation of the DRG reimbursement system. Arndt and Skydell (1985) used the Grace Reynolds Application and Study (GRASP) patient classification system to collect direct and indirect cost data on 30,000 patients in five northeastern community hospitals. Variability of nursing costs/DRG was found both in-hospital and among hospitals. For example, the average nursing cost of DRG 182 (esophagitis, gastroenteritis, and miscellaneous digestive disorders, age >

17 with CC) ranged from a low of $715 to a high of $1433 among the five hospitals. In one hospital, the nursing cost range for DRG 250 (fracture, sprain, strain, and dislocation of forearm, hand, and foot, age > 17 with CC) was $902 to $1770 per stay, a difference of $868 or 96%. Arndt and Skydell's findings of the heterogeneity of DRG's from a nursing resource consumption perspective is supported widely in the literature (Mitchell, Miller, Welches & Walker, 1984; Sovie, Tarcinale, Vanputee & Stunden, 1985; Fosbinder, 1986).

Mitchell et al. (1984) modified the DRG categories by including an in-hospital severity of illness index after their initial nursing cost/DRG study indicated significant heterogeneity. Within these modified DRG's, the variance in nursing costs was reduced. Similarly, Lucke and Lucke (1986) undertook a study to determine whether the inclusion of severity of illness and nursing intensity measures in DRG categories would improve the prediction of direct nursing costs. Severity of illness was measured by the Acute Physiology and Chronic Health Evaluation (APACHE) system, and nursing intensity was measured by an in-hospital patient classification system. Analysis of the findings showed that nursing intensity and DRG factors were equally important in predicting direct nursing costs.

Berki, Ashcroft, and Newbrander (1984) studied factors affecting length of stay in four surgical DRG's and three

medical DRG's. Study variables represented care complexity/severity characteristics, non-clinical patient characteristics, and mode of admission characteristics. Regression analysis indicated that care complexity/severity variables accounted for 31% to 65% of the length of stay variance within DRG's. The results also indicated that DRG's do not provide a reliable system for predicting length of stay, which is a major indicator of nursing resource consumption (Harrell, 1986).

Comparison of the findings of these studies is difficult because the researchers define direct and indirect costs differently, frequently omit methodologies used to convert nursing intensity into nursing time, and use a variety of patient classification systems. Nevertheless, there remains a consensus among the research findings that DRG classifications, without modification, correlate poorly with nursing resource consumption.

Hospital Resource Consumption and DRG's

The heterogeneity of hospital resource consumption within surgical diagnostic-related groups is consistent with the nursing costs/DRG findings. In the literature, hospital cost studies have attempted to correlate the variable costs within DRGs to "clinical identifiers" specific to individual patient cases. Clinical variables identified as significantly increasing resource consumption include a)

admission via emergency department (Munoz et al., 1986; Munoz et al., 1987), b) comorbidity and/or complications (Agarwal, Reyes, Westerman, & Cayten, 1986; Munoz, Friedman, Gerold, et al., 1988), and c) administration of blood or plasma products (Munoz et al., 1987)

Munoz et al. (1986) demonstrated that 75.6% of surgical orthopedic DRG cases admitted via the emergency department (ED) were more costly per hospital stay than their non-ED-matched counterparts. Similarly, Munoz et al. (1987) demonstrated that ED admission, intensive care unit treatment, and consumption of blood or plasma products are "clinical identifiers" associated with increased resource consumption within gastrointestinal DRG's. These "identifiers" had a cumulative effect on costs such that total hospital cost per patient increased with the number of variables per patient within each DRG. Furthermore, Agarwal et al. (1987) found that elderly patients' complicating conditions correlated positively with length-of-stay and cost within a surgical orthopedic DRG. Cases with both comorbidity and complications had significantly longer average length of stay (mean, 61.5 days) as compared to the average for other patients (mean, 26 days) within the same DRG. Similarly, Munoz, Friedman, Gerold, et al. (1988) found that Medicare patients with more CCs per patient had higher total hospital costs than similar patients in the same DRG

with fewer CCs in an analysis of non-CC stratified urology DRGs. Finally, an analysis of age and resource consumption demonstrated the prevalence of "clinical identifiers" among hospitalized Medicare surgical patients (Munoz, Friedman, Schroder, et al., 1988). The occurrence of emergency department admissions, surgical intensive care unit admissions,and blood transfusions increased with the age of the patient.

The heterogeneity of resource consumption within DRGs has been demonstrated in both nursing-based and hospital-based cost studies. Hospital-based studies have identified clinical variables which affect total hospital resource consumption, and those "clinical identifiers" likely have an impact on total nursing care costs. To be effective fiscal managers, nurse administrators need to know where their nursing unit budget dollars are being spent and what variables impact on the consumption of this resource. This study identified and evaluated the impact of clinical variables on total nursing costs and the apportionment of direct and indirect nursing care costs within the study population.

Chapter 3

METHODOLOGY

Research Design

The purpose of this study was to identify and evaluate the impact of clinical variables and organizational costs on nursing resource consumption during the treatment of Medicare patients within DRG 209 (major limb and joint reattachment). The study design was retrospective and descriptive, using statistics of central tendency.

Setting and Sample

The setting for this study was a 40-bed surgical/orthopedic nursing unit at a 468-bed general acute care district hospital in the San Francisco Bay Area. The sample population consisted of Medicare patients, with a principal discharge diagnosis of major limb and joint reattachment (DRG 209), who were admitted to and discharged from the study unit between July 1, 1988 and March 31, 1989. Of the eighty-four patients who met those criteria, eight patients received care in a critical care unit during their hospitalization and were therefore excluded from the study. Patients receiving care in critical care units were excluded because these nursing units did not have a valid instrument with which to measure direct nursing care hours by patient. The seventy-six patients in the study population were divided into subgroups based on age (65-69, 70-74, 75-79, 80-84,

85+), mode of admission (emergency department admission or non-emergency department admission),and the number of complicating conditions (CCs) per case. All patients were separated into three subgroups based on the number of ICD-9-CM complication and comorbidity codes per patient: (a) patients with zero CCs, (b) patients with one or two CCs, and (c) patients with three or four CCs.

Patient Classification Instrument

Direct nursing care hours per patient were obtained by utilizing data from a factor-type patient classification system (PCS) in place on the medical/surgical/orthopedic nursing units (Appendix A). Developed in 1983 through the combined efforts of the facility's Management Engineering and Nursing Departments, point values for each of the forty task-specific cells and tables to convert acuity point scores to required "full-time equivalents" (FTEs) per shift were derived from time-and-motion studies. Required FTEs per shift include professional and non-professional nursing staff, unit-based nursing management and unit-based clerical support. Because of changes in patient mix and mean patient acuity, the validity of the PCS is tested biannually. Time-and-motion reports and retrospective comparisons of actual staffing vs. required staffing based on acuity are used to validate and refine the PCS. During the study period, the surgical/orthopedic nursing unit's actual-to-required

staffing ratio was 1.00. PCS interrater reliability is audited bimonthly (Appendix B), and during the study period, interrater reliability was .96.

Data Collection Procedures

Clinical data were obtained from an in-hospital case-mix database. The case-mix database contains medical diagnosis and procedure information, as well as demographic and billing data for every patient admitted to the facility. Age, length of stay, dates of hospitalization, ICD-9-CM diagnosis codes, mode of admission, and intensive care unit room charges were retrieved from the database for each patient in the study population. Patient acuity data for the calculation of direct nursing care hours and length of stay were retrieved from portable computer disks. Allocated overhead expense figures for the nursing unit studied were retrieved from the hospital's general ledger.

The research proposal was submitted to the setting's Institutional Review Board (IRB) on April 21, 1989, and IRB approval was granted to the researcher on May 1, 1989. The research proposal was submitted to San Jose State University Human Subjects Institutional Review Board on May 12, 1989, and approval was granted on May 30, 1989 (Appendix C).

Cost Methodology

Nursing cost in dollars per patient was derived from a set of equations (see Figure 2).

Figure 2

Nursing Cost Equations

(1) $$\frac{\text{direct nursing care hours}}{\text{shift}} = \frac{\text{acuity points}}{\text{shift}} \div \frac{\text{acuity points}}{\text{direct nursing care hours}}$$

(2) $$\frac{\text{direct nursing care cost}}{\text{hour}} = \frac{\text{accum. nursing unit expense} \div \text{accum. personnel hours}}{\text{productivity}}$$

(PCS required hours ÷ actual hours)

(3) $$\text{total direct nursing care cost} = \frac{\text{total direct nursing care hours}}{\text{hospitilization}} \times \frac{\text{direct nursing care cost}}{\text{hour}}$$

(4) $$\frac{\text{indirect nursing care cost}}{\text{shift}} = \frac{\text{accum. nursing OH + hospital OH allocated to nursing unit}}{\text{accum. nursing unit patient shifts}}$$

(5) $$\text{total indirect nursing care cost} = \text{total number of shifts of care} \times \frac{\text{indirect nursing care cost}}{\text{shift}}$$

(6) total nursing care cost = total direct nursing care cost + total indirect nursing care cost

Direct nursing care cost was comprised of all nursing unit-based expenses, including unit-based personnel, nonchargeable supplies, general/administrative expenses, and unit-based depreciation. Unit-based personnel hours include productive hours and accrued "paid time off" hours of professional and non-professional nursing staff, nurse manager(s), and clerical support staff. Indirect nursing care cost was comprised of both the allocated operating expenses of non-unit based nursing services and allocated hospital overhead. Non-unit based nursing services included Nursing Administration, Utilization Management, Continuing Care (i.e., discharge planning), Recruitment and Retention, Patient Education, and Human Support Departments. These operating expenses were allocated to each nursing unit on the basis of unit staff size measured in FTEs. Other hospital overhead was allocated to each nursing unit as a function of multiple unit-specific characteristics including gross revenue, square footage, total FTEs, utilization of supplies, and general and administrative expense. Nursing costs accumulated in the Emergency Department, Surgery Department, and Recovery Department were assigned to their respective department budgets and were not included in this study.

Analysis of Data.

Using statistics of central tendency, this study was able to identify and evaluate the impact of age, CCs, and

mode of admission on nursing costs within the study population. An analysis of the data provided mean total nursing costs as well as mean hours of direct nursing care +SD, mean length of stay by shift +SD, mean direct nursing care cost, mean indirect nursing care cost, and "nursing care intensity" (a ratio of hours of care per shift). The final data are presented in narrative and tabular form in Chapter 4.

Chapter 4

FINDINGS AND INTERPRETATION OF DATA

Medicare reimbursement for DRG 209 (major limb and joint reattachment) was $10,028 per case. None of the cases exceeded cost or length of stay parameters set by Medicare, and consequently no supplemental reimbursements ("outlier payments") were included in the hospital revenue from these patients. Total hospital revenue received from Medicare reimbursement for the study population was $762,128.

Organizational costs were calculated on a cost per hour basis for direct nursing care and on a cost per shift basis for indirect nursing care. Direct nursing care cost for the surgical/orthopedic unit during the study period was $29.99/hour. Unit-based personnel costs accounted for 96% of the direct nursing care cost. Staff skill mix was 85% registered nurses and 15% licensed vocational nurses/nursing assistants. Personnel expense also included one FTE for a nurse manager and one FTE for clerical support.

Indirect nursing care cost for the nursing unit during the study period was $47.30/shift. Of the total indirect nursing care cost per shift, $9.38/shift (20%) was attributable to non-unit based nursing services and $37.92/shift was attributable to other hospital overhead.

Mean total nursing care cost for the study population (N=76) was $3131 (Table 1), or 31.2% of the total revenue per case. Direct nursing care cost accounted for 56.1% of the total cost and indirect nursing care accounted for 43.9% of the total. A large degree of variance in hours of direct nursing care (mean, 58.60 + 12.49 hours) and length of stay (LOS) by shift (mean, 29.04 + 5.53 shifts) existed among individual cases. Nursing care intensity, the ratio of hours of care per shift, was 2.02 hours/shift for the population as a whole.

Nursing cost per case, and the distribution of that cost among direct and indirect nursing sectors, was affected by the age of the patient, the number of CCs per case, and the mode of admission. Mean nursing care cost, hours of direct nursing care, and length of stay by shift increased with age in the first three age-specific subgroups, but declined in the oldest two subgroups (Table 1). Nursing care intensity increased with the age of the patient, as did the direct nursing care cost share of the total cost (Table 2). Nursing care intensity increased from 1.97 hours/shift for the 65-69 year subgroup to 2.12 hours/shift for the 85+ year subgroup. Similarly, the direct nursing cost share of the total rose from 55.5% in the 65-69 age group to 57.3% in the 85+ age group. Grouping the total population into age-specific groups decreased the variance in hours of care and in length

Table 1

Variance in Nursing Resource Consumption among Age-Specific Subgroups*

Group	N	Mean Direct Care Hours ±SD	Mean LOS by Shift ± SD	Nursing Care Intensity	Mean Total Nursing Cost
					$
Total	76	58.60 ± 12.49	29.04 ± 5.53	2.02	3131
65-69	12	54.93 ± 8.22	27.90 ± 3.48	1.97	2967
70-74	19	55.75 ± 8.57	28.16 ± 3.72	1.98	3004
75-79	13	63.01 ± 9.64	31.54 ± 4.58	2.00	3382
80-84	19	61.54 ± 10.23	30.33 ± 4.89	2.03	3281
85+	13	57.28 ± 7.22	27.00 ± 4.67	2.12	2995

Table 2

Distribution of Total Nursing Cost by Direct and Indirect Nursing Care Costs

Group	N	Mean Direct Care Cost	Mean Indirect Care Cost	Nursing Care Intensity	Mean Total Care Cost
					$
Total	76	1757 (56.1%)	1374 (43.9%)	2.02	3131
65-69	12	1647 (55.5)	1320 (44.5)	1.97	2967
70-74	19	1672 (55.6)	1332 (44.4)	1.98	3004
75-79	13	1890 (55.8)	1492 (44.2)	2.00	3382
80-84	19	1846 (56.2)	1435 (43.8)	2.03	3281
85+	13	1718 (57.3)	1277 (42.7)	2.12	2295
0 CC	21	1505 (55.0)	1230 (45.0)	1.93	2735
1-2 CC	40	1727 (55.8)	1365 (44.2)	1.99	3092
3-4 CC	21	2115 (57.1)	1589 (42.9)	2.10	3704
ED +	24	1778 (58.8)	1244 (41.2)	2.26	3022
ED -	42	1692 (54.0)	1436 (46.0)	1.86	3128

of stay among members of each subgroup (Figures 3 and 4).

Mean nursing care cost, hours of direct nursing care, and length of stay, increased as CCs per patient increased (Table 3). Nursing care intensity also increased with the number of CCs per case, as did the direct nursing care cost share of the total cost (Table 2). In comparison with the total population, variance in hours of care and length of stay decreased within the zero CCs subgroup and the one-two CCs subgroup (Table 3), and this level of variance was comparable with the level of variance found within age-specific subgroups. Variance within the three-four CCs subgroup was greater than in the study population as a whole.

The trend of increasing nursing costs, hours of care, length of stay, and nursing care intensity with increases in the number of CCs per patient remained consistent in subgroupings based on both age and CCs (Table 3). Variance in direct nursing care hours and length of stay was less than that of the total population (Figures 5 and 6). Similarly, these subgroups displayed less variance than the age-specific and the CC-specific groupings (Table 2).

Unlike age and CCs subgroupings, variance within groupings based on mode of admission (emergency department admission or non-emergency department admission) did not decrease from that of the total population, and was greater than that in either the age-specific or CC-specific subgroups

Figure 3

Variance in Direct Nursing Care Hours within Age-Specific Subgroups

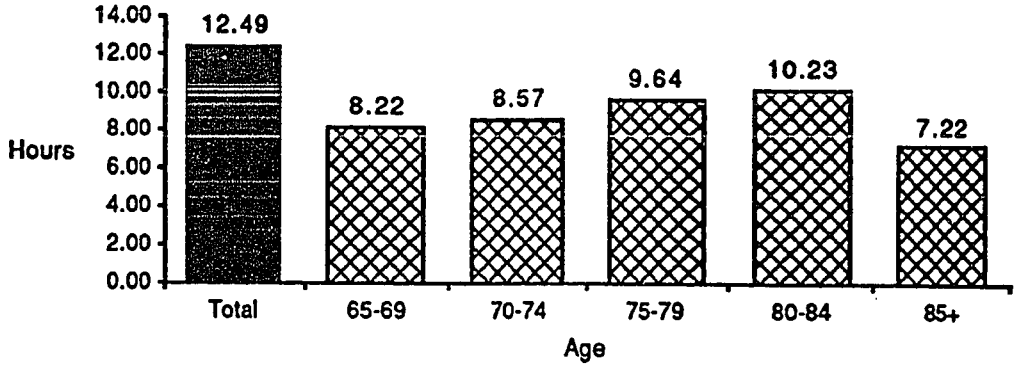


Figure 4

Variance in L.O.S. (by shift) within Age-Specific Subgroups

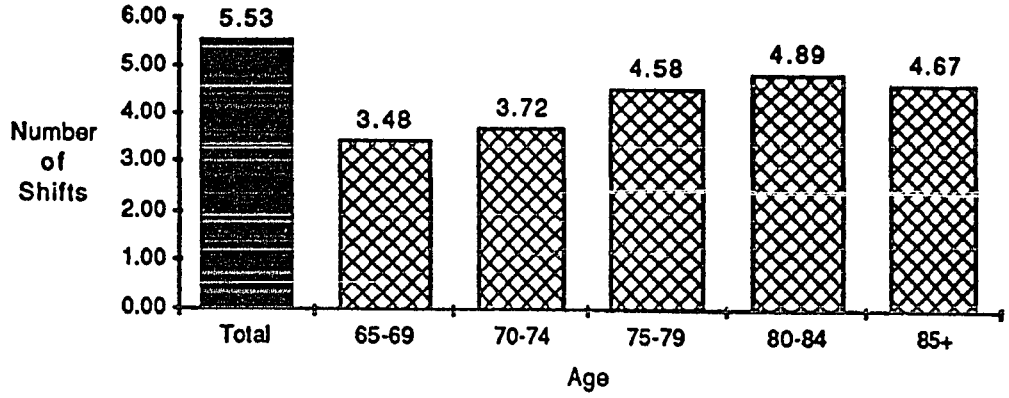


Table 3

Variance in Nursing Resource Consumption among CC-Specific Subgroups*

Group	N	Mean Direct Care Hours ±SD	Mean LOS by Shift ± SD	Nursing Care Intensity	Mean Total Nursing Cost
					$
Total	76	58.60 ± 12.49	29.04 ± 5.53	2.02	3131
0 CC	21	50.20 ± 6.05	26.00 ± 3.09	1.93	2735
1-2 CC	40	57.57 ± 8.16	28.86 ± 3.99	1.99	3092
3-4 CC	21	70.54 ± 15.08	33.60 ± 6.97	2.10	3704
65-69					
0 CC	5	53.85 ± 5.40	27.80 ± 2.13	1.94	2930
1-2 CC	7	55.84 ± 7.86	28.00 ± 3.08	1.99	2999
3-4 CC	0	no data			
70-74					
0 CC	6	48.31 ± 3.92	26.50 ± 2.43	1.83	2702
1-2 CC	9	57.33 ± 7.99	28.11 ± 3.41	2.03	2963
3-4 CC	4	63.23 ± 6.96	30.75 ± 4.43	2.06	3350
75-79					
0 CC	4	45.99 ± 7.08	24.50 ± 4.38	1.88	2538
1-2 CC	6	57.66 ± 7.99	29.33 ± 3.40	1.97	3116
3-4 CC	3	96.39 ± 3.50	45.33 ± 2.05	2.13	5035

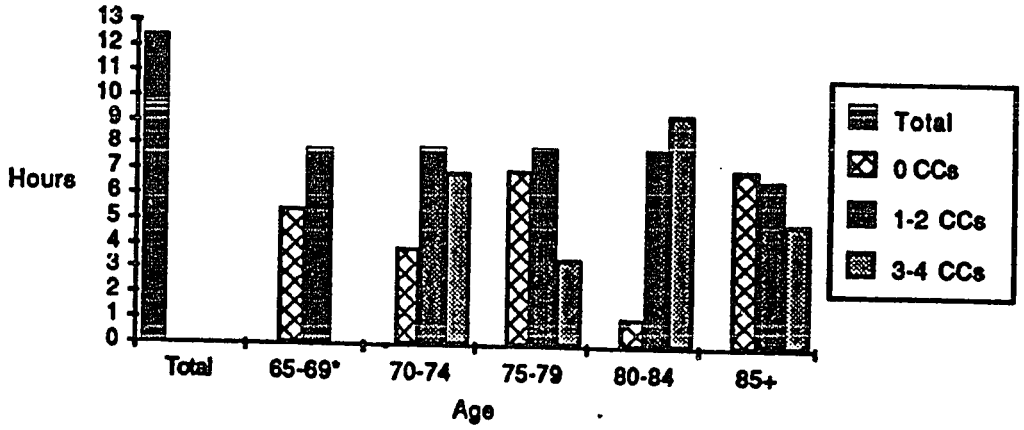
Note. *See next page.

Table 3 (Continued)

Group	N	Mean Direct Care Hours ±SD	Mean LOS by Shift ± SD	Nursing Care Intensity	Mean Total Nursing Cost
					$
80-84					
0 CC	3	50.10 ± 1.19	25.66 ± 0.47	1.95	2716
1-2 CC	12	60.73 ± 8.03	30.17 ± 5.06	2.01	3248
3-4 CC	4	69.91 ± 9.42	33.25 ± 3.27	2.10	3670
85+					
0 CC	3	53.56 ± 7.14	24.33 ± 3.14	2.20	2757
1-2 CC	6	57.84 ± 6.81	27.67 ± 2.98	2.09	3044
3-4 CC	4	59.25 ± 5.00	28.00 ± 2.45	2.12	3104

Figure 5

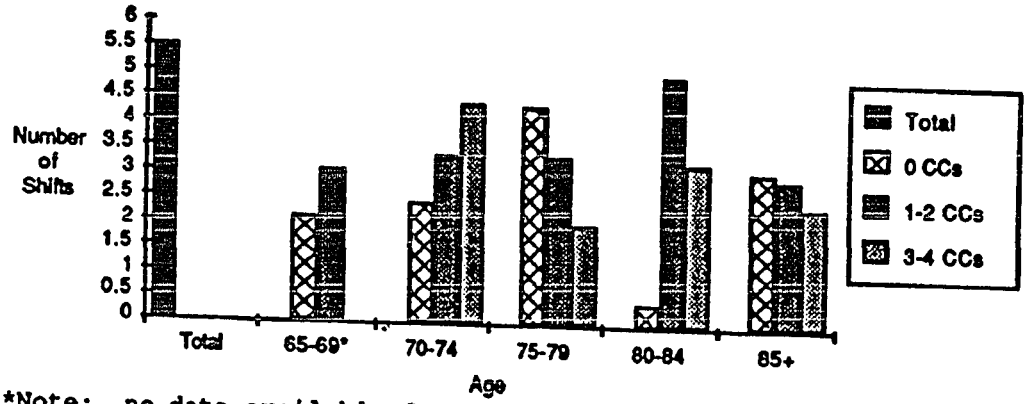
Variance in Direct Nursing Care Hours within CC-Specific Subgroups



*Note: no data available for 3-4 CCs.

Figure 6

Variance in L.O.S. (by shift) within CC-Specific Subgroups



*Note: no data available for 3-4 CCs

(Table 4). Mean total nursing cost for the emergency department admission (ED+) subgroup ($3022) and the non-emergency department admission (ED-) subgroup ($3128) was comparable, but the distribution of the total cost between direct and indirect care sectors was different. ED+ cases required slightly more total hours of nursing care (ED+ mean, 59.29; ED- mean, 56.44) (Table 4), but the average length of stay for the ED+ case was substantially shorter than the ED- case (ED+ mean, 26.29; ED- mean, 30.36). Consequently, the nursing care intensity and the percentage of direct nursing care cost was higher among ED+ cases (Table 2). One factor accountable for this difference may have been the older mean age of the ED+ subgroup (ED+ 82.25 years; ED- 75.66 years); the mean number of CCs per patient was comparable (ED+ 1.46 CCs; ED- 1.48 CCs).

The variance within subgroups based on both mode of admission and age decreased slightly from that of the total population (Table 4), but these groupings remained more heterogeneous than the age-specific and CC-specific subgroupings. Total nursing care cost was higher for all ED- subgroups except for the 70-74 subgroup which had comparable ED+ ($3059) and ED- ($2991) costs. Higher nursing care intensity among ED+ subgroups remained a consistent trend in these subgroups.

Table 4

Variance in Nursing Resource Consumption among Mode of Admission-Specific Subgroups

Group	N	Mean Direct Care Hours ±SD	Mean LOS by Shift ± SD	Nursing Care Intensity	Mean Total Nursing Cost
Total	76	58.60 ± 12.49	29.04 ± 5.53	2.02	$ 3131
ED +	24	59.29 ± 15.66	26.29 ± 6.46	2.26	3022
ED -	42	56.44 ± 9.96	30.36 ± 4.70	1.86	3128
65-69					
ED +	0	no data			
ED -	12	54.93 ± 8.22	27.90 ± 3.48	1.96	2967
70-74					
ED +	3	57.84 ± 10.11	28.00 ± 5.66	2.07	3057
ED -	16	55.30 ± 8.08	28.19 ± 3.23	1.96	2991
75-79					
ED +	5	52.29 ± 9.86	21.83 ± 5.00	2.40	2601
ED -	8	69.71 ± 22.00	34.86 ± 8.67	2.00	3740
80-84					
ED+	9	58.88 ± 11.19	27.44 ± 3.89	2.15	3064
ED -	10	62.77 ± 9.00	32.40 ± 4.54	1.94	3415
85+					
ED +	7	52.25 ± 5.60	24.14 ± 4.12	2.16	2709
ED -	6	63.16 ± 3.50	30.33 ± 2.63	2.08	3329

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

The implementation of the prospective payment system for reimbursement of patient care costs has increased the need for a system of financial management wherein a) the cost of hospitalization can be separated into its component parts, b) variations in cost among similar cases can be identified, and c) strategies to maintain economic viability and satisfactory patient outcomes can be developed. The cost and quality of nursing care has a significant impact on both the cost of hospitalization and patient outcome. Consequently, nurse administrators must actively participate in the accumulation of nursing cost and patient outcome data and in the development of cost control standards. This study has contributed to the existing DRG/nursing cost database by identifying and evaluating clinical variables and organizational costs that affect nursing resource consumption during the treatment of Medicare patients within DRG 209 at a 468-bed general acute care district hospital in the San Francisco Bay Area.

Conclusions

DRG 209 (major limb and joint reattachment) is a non-age, non-CC stratified diagnostic-related group, and therefore Medicare reimbursement is not affected by the patient's age or presence or absence of complicating

conditions (CCs). This study, however, found that age and number of CCs do have an impact on nursing resource consumption. Mean total nursing cost per case, hours of direct care, and length of stay increased with age of patient to age 79, and then declined. Similarly, mean total nursing cost per case, hours of direct care, and length of stay increased as the number of CCs per case increased. The impact of these two "clinical identifiers" on total resource consumption is consistent with the findings of hospital-wide cost studies. Furthermore, these "clinical identifiers" had an impact on the distribution of organizational costs. Direct nursing care costs also accounted for an increasing percentage of total nursing care costs as the patient's age and number of CCs per case increased.

The impact of mode of admission (ED+, ED-) on mean total nursing cost per case was minimal, but the comparative distribution of direct and indirect nursing care costs among ED+ and ED- cases was interesting. ED+ cases had shorter lengths of stay, but averaged more direct nursing care hours per shift when compared with ED- cases. Consequently, the direct nursing care costs among ED+ cases accounted for a larger percentage of the total nursing costs than in the ED- group.

The heterogeneity of nursing costs among DRG 209 cases found in this study supports the findings of other nurse

researchers. Total nursing cost per case ranged from $2124-$4965. The variance in nursing resource consumption among cases was a function of both a variance in hours of direct nursing care and a variance in length of stay. Finally, when the study population was grouped by age and CCs, the variation in costs per case within each subgroup narrowed considerably.

The "resource-driven costing/productivity model" provides nurse administrators a structure within which nursing cost components can be identified, cost containment strategies can be evaluated, and cost control standards can be developed. In this study, the mean revenue per case was $10,668, and the mean total nursing cost per case was $3131, or 31.2% of the total revenue. The model's nursing hours per patient day (NHPPD) and staff skill mix cost components accounted for 56.1% of the total cost. The model's nursing overhead cost component accounted for an aggregate 43.9% of the total:non-unit based nursing service operating overhead was 8.7% and other allocated hospital overhead was 35.2%.

The nurse administrator can implement and evaluate cost containment strategies for three of the cost components: NHPPD, skill mix, and non-unit based nursing services, representing approximately 65% of the total mean nursing cost per case in this study. Personnel costs, accounting for 96% of each direct nursing care dollar in this study, were driven

by NHPPD and nursing skill mix. Consequently, containment of personnel costs is possible through the nurse administrator's manipulation of NHPPD and/or staff mix. NHPPD reflects the hours of nursing care "required" by the patient. This "required" level of nursing care is defined by a patient classification system that establishes a particular level of productivity and patient care as reasonable. One strategy for containing NHPPD costs, therefore, would be to manipulate the PCS (i.e., alter the acuity points/FTE ratio) so that the established level of productivity is raised.

Altering the staff skill mix to decrease the gross labor costs per hour is another strategy for containing personnel costs. Nursing care delivery systems, such as primary, team, and all-RN nursing staffs, can be altered by the nurse administrator to meet both cost constraints and patient care requirements on a unit by unit basis, although differences of opinion about the costs and benefits of delivery systems remain controversial in the nursing community at this time.

Non-unit based nursing services accounted for only 20% of nursing overhead and 8% of total nursing cost per case. Nevertheless, the operating expenses of these cost centers are affected by the nurse administrator's personnel cost containment strategies. For example, the demand for increased nursing productivity may result in a decrease in NHPPD, but the operating expenses in cost centers such as

Recruitment and Retention, Nursing Administration, and Continuing Care may increase.

Finally, nurse administrators have only a peripheral influence in cost containment of hospital overhead allocated to the nursing units' budgets and representing 35% of the total nursing care cost. Nursing influence over this cost component exists only at the committee level, such as in utilization management, materials management, and executive steering committees.

The difference between a nurse administrator's cost containment and cost control activities lies in the starting point. While cost containment starts with the actual level, cost control starts with establishing standards to indicate what the cost should be under efficient operating conditions. If deviations from the standards take place, reasons for their occurrence can be investigated and efforts for establishing accountability properly can be made. Nurse researchers have only recently begun accumulating the nursing cost and patient outcome database upon which cost control standards can be developed. Consequently, although this study finds that 31.2% of total revenue per case is consumed by nursing care and that the distribution of direct to indirect care is approximately 56%-44%, there exists no standard to indicate what the cost or distribution of cost should be under efficient operating conditions.

Recommendations

The results of this study suggested several areas in which further research is indicated, such as:

1. Identify specific complications and their associated nursing resource consumption in DRG 209 cases.

2. Identify the impact of physician orders, nursing orders, and basic care tasks on nursing resource consumption in DRG 209.

This study has investigated the impact of clinical variables and organizational costs in the nursing care of patients requiring major limb or joint reattachment. Nursing economics research is in its infancy, and a vast amount of descriptive and correlational cost data remains to be collected. Future investigation needs to remain twofold in its objectives: a) continue to add to the nursing cost/DRG database; and b) continue to work toward developing standard measurement instruments and cost methodologies for the nursing profession.

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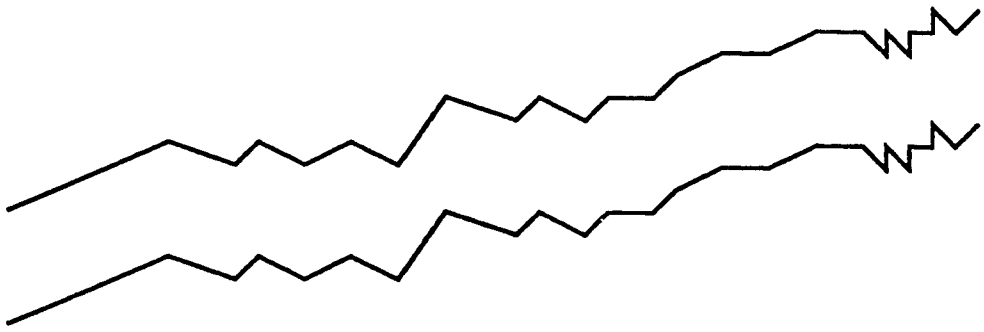
APPENDIX A

Patient Classification Instrument

CARE ACTIVITY	CARE REQUIREMENTS			
Hygiene (Bath, Oral)	Totally Independant for Self Care	Bed Bath with self help	Shower with assist	Complete bath/shower
Eating	Feeds Self MPO	Set up with assist Fluid restrict	Slow Eater Assist and Encourage	Total Feed x 2/shift



Teaching/ Discharge	Teaching or Discharge Planning	Discharge Planning for patient and/or family	Multiple teaching and discharge planning	Long term multi-system teaching needs with 3 or more meds

Note. The patient classification instrument was truncated at the request of El Camino Hospital.

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APPENDIX B

Current Acuity Audit Process

CURRENT ACUITY AUDIT PROCESS

1. Currently there is one R.N. auditor per shift. This nurse should be experienced with the acuity system, and possess good interpersonal skills.

2. Selection of the patients to be audited should be done by random room assignment. This protects the validity of the audit.

3. The audit should be labeled with:
   - Patient's name
   - Auditor's name
   - Staff nurse's name
   - Date of audit

4. The auditor first reads:
   - Nursing Care Plan
   - Medical Care Plan
   - Basic Care Needs

   and then acuitizes that patient on the audit sheet according to this information.

5. The staff nurse's actual acuity for that patient is copied on the Audit Sheet for comparison. Any discrepancy in noted on the sheet and discussed with the staff nurse. Comments and agreement are noted on the audit sheet.

6. Each audit should also be considered a critique of the tool. New procedures or tasks that are not captured should be noted for later input when that tool is modified.

7. The auditor's time is coded to AD.

8. This audit is performed every other month.

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APPENDIX C

Project Approval

EL CAMINO HOSPITAL
2500 GRANT ROAD, P.O. BOX 7025
MOUNTAIN VIEW, CA 94039-7025
415-940-7000

May 1, 1989

Michael Thille, RN
1390 Kingfisher Way #3
Sunnyvale, California 94087

Dear Michael,

I am pleased to inform you that the Nursing Research Advisory Committee recommends that your research study, "Nursing Resource Consumption: DRG 209, A Case Study" be accepted. You have permission to do the study at El Camino Hospital. I ask that you share the results of the study with the Nursing Research Advisory Committee, and that you keep them informed of any changes or difficulties you encounter during the course of the study. Your project is very worthwhile and I wish you success in this endeavor.

Sincerely,

Mary

Mary Smithwick, RN, MS
Administrator, Nursing

cc: Johanna K. Stiesmeyer, RN, MS, CCRN
Chair, Nursing Research Advisory Committee

SAN JOSE STATE UNIVERSITY
GRADUATE STUDIES AND RESEARCH

HUMAN SUBJECTS INSTITUTIONAL REVIEW BOARD
PROJECT PROPOSAL REVIEW

Regular Review ☐ Expedited Review ☒ Deadline Date _____

I, the undersigned member of the San Jose State University Human Subjects Institutional Review Board, have reviewed the following proposal submitted to the Board on 5/12/89 by:

PRINCIPAL INVESTIGATOR: Michael Thille
PROTOCOL #: 7504 DEPT: Nursing
PROJECT TITLE: Nursing Resource Consumption: DRG 209, A Case Study

I recommend the following action (indicate one):

1. Approved for clearance as involving minimal risk to Human Subjects. ☒

2. Approved for clearance with risk to Human Subjects. ☐

3. Approval depends upon the satisfactory completion of the following conditions. ☐

4. I have serious concerns about this protocol and it should go before the full committee to review. ☐

Ruth Morrow, Ph.D. 19 May 89
Signature of IRB-HS member Date

5. Not Approved. ☐ Approved. ☑

OFFICIALS SIGNING FOR INSTITUTION

Joni Campbell 5/24/89
Chair, Human Subjects Institutional Review Board Date

Serena Stanford 5/26/89
Serena Stanford, Ph.D. Date
AAVP for Graduate Studies & Research

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